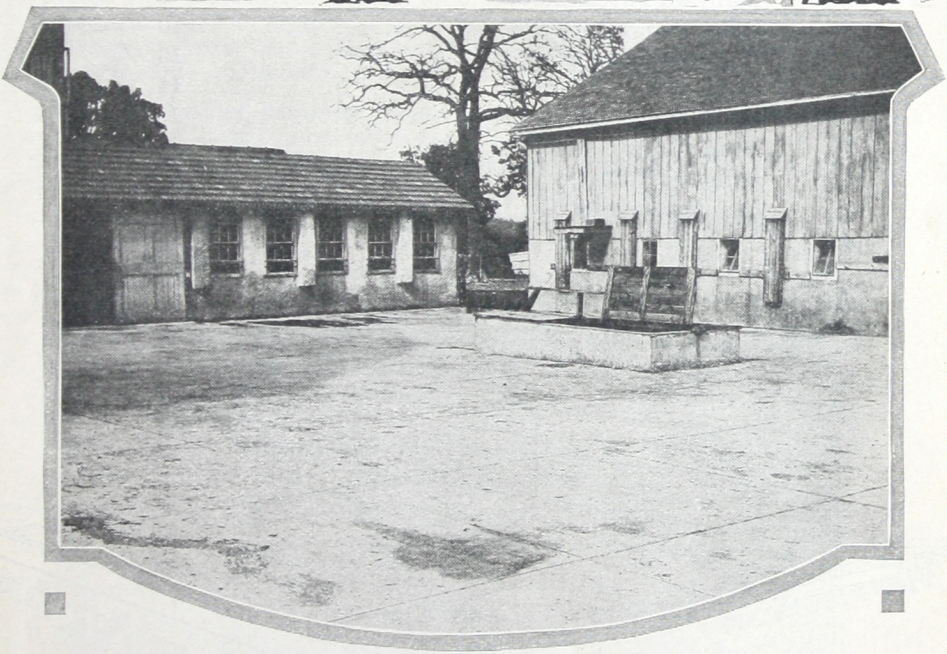
Concrete in the Barnyard



UNIVERSAL PORTLAND CEMENT CO.
CHICAGO—PITTSBURGH—MINNEAPOLIS

Concrete in the Barnyard

BY THE INFORMATION BUREAU

Universal Portland Cement Co.

CHICAGO—PITTSBURGH—MINNEAPOLIS

CONTENTS

	Page
Notes on the Construction of Concrete Floors	5
Feeding Floors	7
Hog Wallows	8
Barnyard Pavements	8
Dairy Barn Floors	10
Hog House Floors	13
Stock Tanks	14
Small Troughs	18
Manure Pits	20
Barnyard Walls	28
Requirements for Certified Milk Production	30

5-1-14-300M—D.

Second Edition

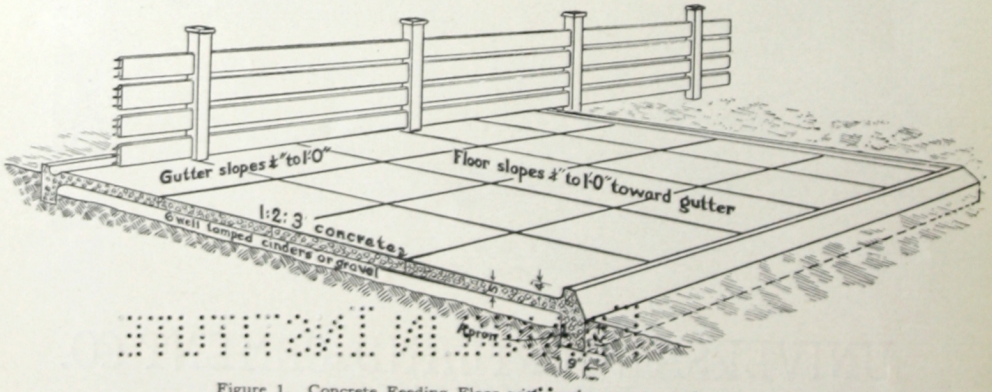


Figure 1. Concrete Feeding Floor with curbs, aprons and gutters.

Concrete in the Barnyard

Introductory. A manufacturer with a clean, well arranged and well equipped establishment often receives a handsome dividend while his competitor with a poorly fitted, unsanitary factory loses money. It is the same in the business of farming. Clean, well equipped and handily arranged barnyard and buildings tend to bring financial success.

The progressive, business-like farmer modernizes his farm with concrete foundations under the barn, concrete floors and good drainage. After these improvements comes a concrete hog wallow and the floor is extended until it covers the entire barnyard. Then must come a concrete stock tank and manure pit and a concrete wall to protect stock from winter winds.

Cleanliness. On the farm producing milk or butter, these improvements are necessary for convenience and common cleanliness and, in some states, are made compulsory by law. Health officers have raised to a remarkable degree the standards of cleanliness in barns and barnyards and, therefore, in the product, with consequent rise in the prices obtained by the farmer. Profits are largely dependent upon proper feeding and care and if stock do well in dirty, unsanitary surroundings it is in spite of the filth.

Proof Against Rodents. Rats, mice and other rodents are germ distributers and troublesome where grain is stored or fed to animals. While wood floors harbor these pests, concrete floors prevent them for they

Figure 2. Concrete feeding floor on the farm of Ed. Kearns, Naperville, Ill.

cannot gnaw through concrete nor will chaff or grain work through. Concrete floors, therefore, protect stock from contagious diseases carried by rodents and prevent loss of grain.

Permanence. A concrete floor is built only once and is comparatively inexpensive. It will pay for itself in a short time in the saving of feed and labor. This is true of a barn or other building floor, a feeding floor or a barnyard pavement. A concrete floor can be laid as cheaply as oak planks and 2 x 8 inch stringers.

Simplicity. The farmer does not need to be an expert concrete worker to modernize his barn. The principles of good construction with concrete are simple and the work may be built a little at a time as regular farm duties will permit. Certainly no more work is involved in building permanently with concrete than would be required to build and keep in repair any structure of wood and the cost of concrete will in the end be less than that of wood.

Cost. The following are approximate cost figures for floors: Suppose you are to lay 100 square feet of 5-inch concrete floor using a mixture of 1:2:3, with cement costing $2.00 per barrel and sand and gravel at 50c per cubic yard. A 1:2:3 mixture means that the concrete is mixed in the

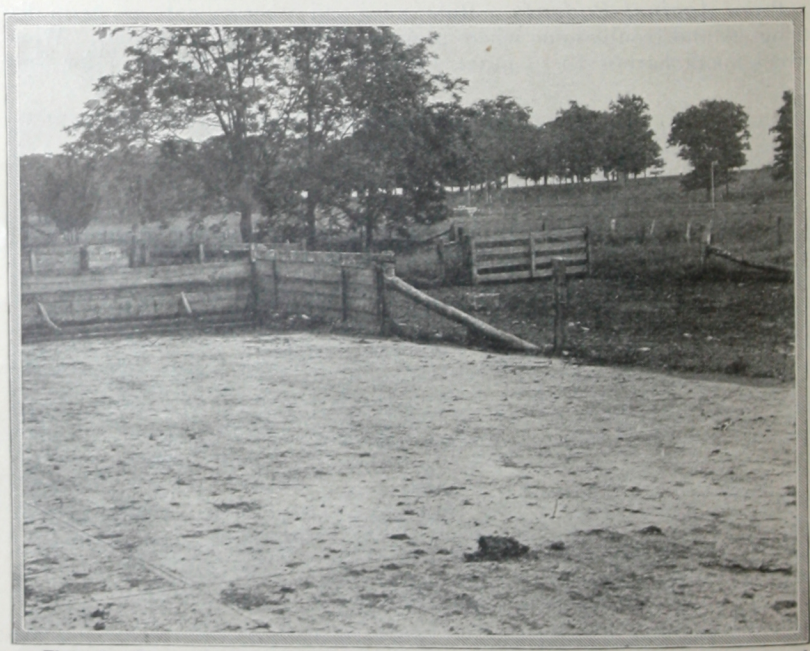


Figure 3. Corner of a Concrete barnyard pavement which is also used as a feeding floor. A clean, convenient, and economical place to feed animals and a great labor saver for the owner.

proportion of 1 sack of cement, 2 cubic feet of sand and 3 cubic feet of screened gravel. The materials will then figure out about as follows:

Cement, 11 sacks (2¾ bbls.)
Sand, 1 cubic yard
Gravel, 1¼ cubic yards

The total cost of these will come to about $6.60. It will be necessary, sometimes, to lay the concrete on a 6-inch fill or sub-base of gravel or cinders which may bring the cost up to slightly more than this figure.

If you buy sand and gravel, which is not always necessary, and if the ground requires that a sub-base be put in, the price will be more than 6 cents per square foot. If you have sand and gravel near by and a filler is not needed the cost will run much less.

The Construction of Concrete Floors

Sub-base for Inside Floors. Whether or not to use a sub-base under a concrete floor depends on the nature of the soil and upon whether the floor is indoors and protected, or outdoors and subject to frost. In inside work where the ground is firm and thoroughly settled a sub-base is unnecessary but the ground must be compact and moisture must not go below the finished floor if there is a possibility of freezing. If a sub-base is not used the ground should be sprinkled with water and compacted with a tamper. But if it is necessary to fill in the space below the floor with loose dirt a sub-base is advisable. Ordinarily 6 to 8 inches of gravel is sufficient. This should be compacted and leveled off before laying the floor.

Sub-base for Exposed Floors. For outside work, if the soil is heavy and holds water, a gravel sub-base is necessary and no matter what kind of earth is to be covered, a sub-base is necessary if the ground is so sloped that surface water can run down below the floor. Yet with a good, natural drainage and a loose soil a sub-base is not needed.

For outside work, the gravel or cinders should be 8 inches deep and well compacted by wetting and tamping.

Floor Forms. Floor forms must be placed carefully. Make them of 2 x 4's or larger planks, held rigidly in place by strong stakes set close enough together so that the forms will not bulge. The floor should have a pitch or slope of ⅛ to ¼-inch to the foot to drain properly.

Drainage. Besides pitching the floor, avoid dips or hollows in the surface in which water would stand. Make the floor drain to a gutter along the middle or along one side and keep the surface free from hollows by using a straightedge across the floor forms. The kind of gutter or drain will be explained later as it varies with the type of floor.

Thickness, Mixture and Consistency. Single course floors for farm buildings should be 5 to 6 inches thick with concrete mixed in the proportions of 1 sack of cement to 2 cubic feet of coarse, clean sand and 3 cubic feet of screened gravel or crushed stone. For two-course floors use a 1:3:5 mixture in the base and provide a ¾ to 1-inch top coat of cement

mortar. Mix this in the proportion of 1 sack of cement to 2 cubic feet of sand.

For single course work use enough water so that the concrete is "quaky." It will then need little tamping. If a top coat of rich mortar is to be put on, the first course should be stiffer and then it will need sound tamping to make the concrete compact and bring the water to the surface.

Single Course Work. For floors of barns, hog and poultry houses, sheep sheds and ice houses, one course work is to be recommended. In this case the entire slab is placed at one time and the top finished off with a wooden trowel. A mortar coat as used for sidewalks is not put on but a small amount of mortar may be spread over the surface if necessary to trowel the surface smooth. It is good practice to brush the concrete with a broom before it is hard, so as to give a better footing for animals along runways and in the stalls.

Surface Coat. Mangers and gutters are improved by giving a thin coat of cement mortar and finishing with a steel trowel. Trowelling draws the cement and finer sand particles to the top, making the surface smooth, but too much of this treatment causes checking and should be avoided.

Floors of milk houses and creameries should be finished in this way, making the surface coat 1 inch thick. You must not fail to put on the finished coat before the concrete forming the body of the floor is hard and dry. If it should become dry you must clean and wet it thoroughly before putting on the mortar. If you are working during hot weather you should protect the floor for several days to prevent drying out. Wet straw is a good protection but it should not be put on until the concrete has begun to set or it will mark the surface. Keep the straw damp for a week or ten days. This is especially necessary for outside floors exposed

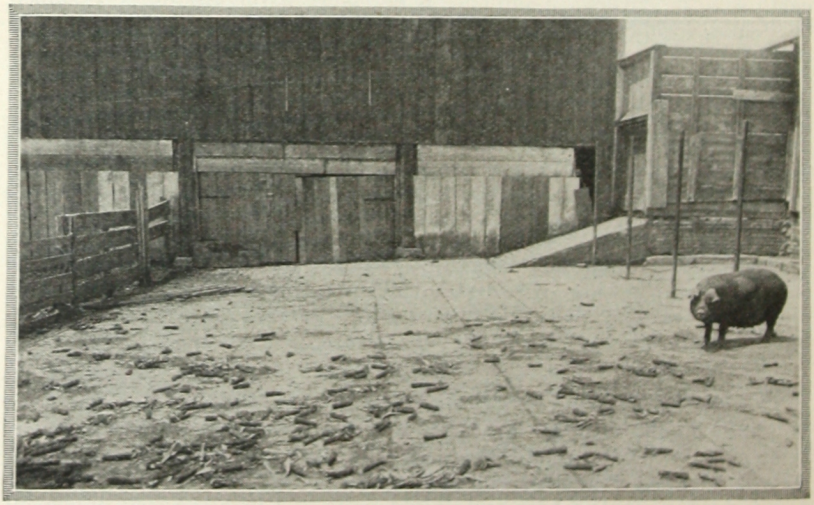


Figure 4. Where corn is fed at the Bureau County (Ill.) Infirmary.

to the sun. If working in freezing weather heated materials should be used and the work covered with straw or manure for a week or ten days.*

Expansion and Contraction. Do not build concrete floors inside buildings without cutting up into squares 10 feet or less in both directions and for outdoor floors do not make the squares larger than 6 feet in either dimension. This prevents cracking as a result of any unequal settlement or through expansion and contraction due to changing temperatures. The lines of division must extend through the entire depth of the slab, as a line marked on the surface will do no good whatever.

Feeding Floors

Advantages. Experienced hog raisers say that a good concrete floor will pay for itself in a season, and that it will remain a permanent improvement and a perpetual protection against hog cholera and other disease germs which infest wooden floors. Experts of several State Agricultural Colleges estimate that a concrete floor will effect a saving of 1/3 in feed and that the hogs will gain weight faster because they do not have to pick up a large quantity of dirt with their feed.

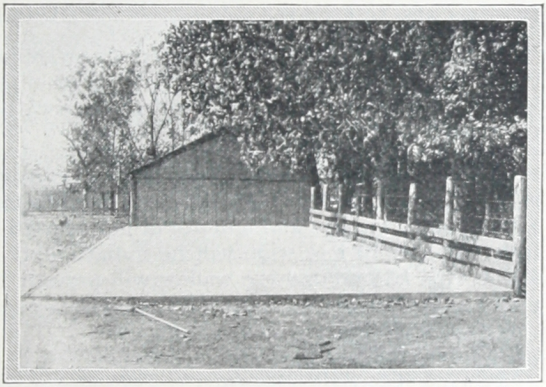


Figure 5. A Concrete Feeding Floor near Centerville, Indiana.

Although it is common practice to feed pigs within the hog house it is a better plan to build a feeding floor apart from the house. This gives them some exercise and helps to keep them healthy.

The feeding floor may be of any shape but most farmers prefer a square floor. It should have sunlight all day long. Fifty pigs require a floor at least 24 x 36. This allows 18 square feet of floor per hog and you can figure out from this the necessary area for your drove. It is not convenient or economical to build less than 100 square feet of floor even for a few hogs.

The curb as shown in Figure 1 will prevent hogs from working the feed off the floor, and the apron, going down a foot on all sides, will prevent them from rooting underneath. Pitch the floor ¼ inch to the foot toward a concrete gutter along one side. Finish the surface with a wooden trowel or float which will leave it rough enough to prevent slipping. For the proper proportions of concrete see general instructions on page 5. Divide off the floor into slabs not more than 6 feet square providing divisions clear through each at the joints.

*Detailed directions for the care of concrete work in winter will be found in "Concreting in Cold Weather" Rural Edition, published by this company.

A 5-inch concrete floor 24 x 36 feet, without curbs and aprons, using a 1:2:3 mixture, will require about 93 sacks of cement, 7 cubic yards of sand and 10¼ cubic yards of stone. Do not let the hogs on the floor until it is quite hard, as they will ruin the surface of the green concrete.

Hog Wallows

The concrete hog wallow is needed by every hog raiser. It accomplishes two things. Hogs will lie in the water to cool off when warm, and the wallow provides a practical scheme for killing vermin when crude oil or other disinfectant is added to the water. The wallow serves as a dipping vat and saves the trouble of dipping, if a small amount of oil is kept in the wallow at all times. The crude oil stays on the surface of the water and, therefore, will not escape through the outlet. It serves also to keep the skin of the animals in good condition.

Location. Locate the wallow near the water supply. If from a spring the water may flow through the pool continuously but if from a tank the wallow should be emptied and refilled at intervals. A good plan is to drain the outlet to the nearest line of tile.

Construction. The general shape and construction of a good wallow is shown in Figure 6. It is most convenient to make the pool rectangular with rounded corners and a depth of not over 18 inches. A pool 15 to 20 feet long and 10 feet wide will be found amply large. A concrete floor 4 feet wide laid around the wallow will prevent the hogs from burrowing under or carrying in mud.

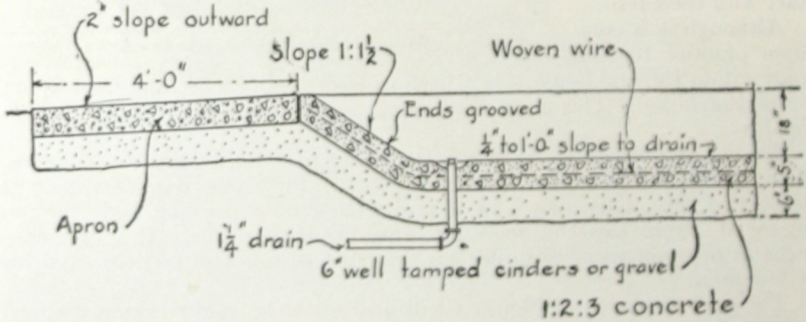


Figure 6. Partial Sectional View of a Concrete Hog Wallow. The wallow is simply a big concrete bowl with a floor 4 feet wide around the edge.

Barnyard Pavements

After you have used a concrete feeding floor no argument will be needed for a concrete pavement in the barnyard. It is a great convenience and saving of labor. It gives plenty of room for feeding stock, piling straw and manure and improves the sanitary condition of the barnyard.

Construction. The barnyard floor is easy to build and is so similar to the feeding floor that the same instructions will cover this work. See page 7. It is simply a feeding floor large enough to cover the entire barnyard. It is a good plan to study out the changes you intend to make in the future in the layout of the yard and the position of small buildings and tanks before placing the pavement, for a concrete floor is hard to move.

Figure 7. A ramshackle barn and submerged barnyard where dust, dirt and filth abound. A recent epidemic of infantile paralysis near Chicago was traced to a filthy cow stable and even more filthy barnyard.

Providing for Future Tank. If you plan to build a concrete stock tank later, leave a space for it in the barnyard, running the pavement around the area needed for the tank foundation, and making provision for the necessary piping. The opening should be one inch larger each way than the outside dimensions of the tank.

Slopes. If the barnyard is on a hill-

Figure 8. Clean buildings and a barnyard pavement of concrete. Dry and sanitary 365 days a year. This pavement, on the farm of H. Stillson Hart, Barrington, Ill., has paid for itself each year in a saving of labor alone.

side, grade this down to give the floor as gentle a slope as possible. It must not slope more than 1 foot in 10 without roughing off the surface to prevent slipping.

Dairy Barn Floors

Design. Figure 10 shows a sectional view and elevation of a cow barn floor with manger and gutter moulded in concrete. It is planned for adjustable steel stanchions and the length of the stall is that needed for cows of average size. You can adjust the stanchions considerably with most makes.

Construction. In laying the floor follow the general instructions of the preceding pages. You should lay the floor in front of the manger first, which should be 18 inches above the level of the floor or drive back of the gutter. It should be a single course slab 5 inches thick and sloped ¼-inch per foot toward the manger. Level the forms to obtain this slope.

Manger and Curb. The next section to be laid is the manger and curb which should be 6 inches thick, building up the curb so as to extend about 10 inches above the surface of the stall floor. Put up a rigid plank to form the side of the curb and build a template as shown in Figure 11, to bring the manger to shape. Put a little extra mortar on the surface and finish it with a steel trowel, leaving the surface quite smooth. Some of the barn equipment companies furnish guide bars, bent to proper curvature, for building the manger, in which case a template is dispensed with and the manger shaped with a strike board handled parallel to the curb.

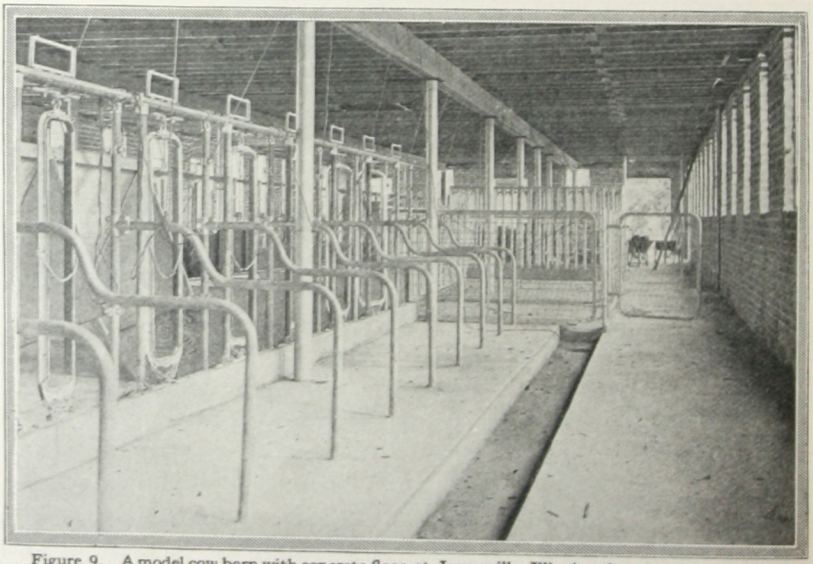


Figure 9. A model cow barn with concrete floor at Jerseyville, Illinois, where cows are easily kept clean and healthy and the owner retains his self-respect. Appetizing, wholesome milk is produced here.

Before placing the concrete for the curb, set in the stanchion supports or bolts, spacing them accurately. Finish off the curb smooth to prevent injuring the necks of the animals.

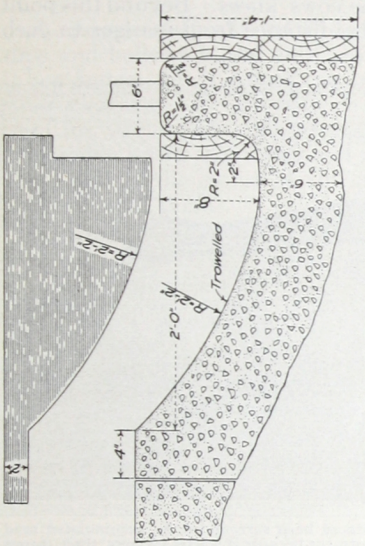
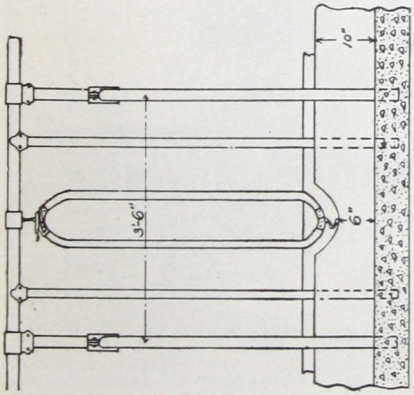


Figure 11. Template and Forms for Manger and Curb.



ELEVATION OF COW STALL

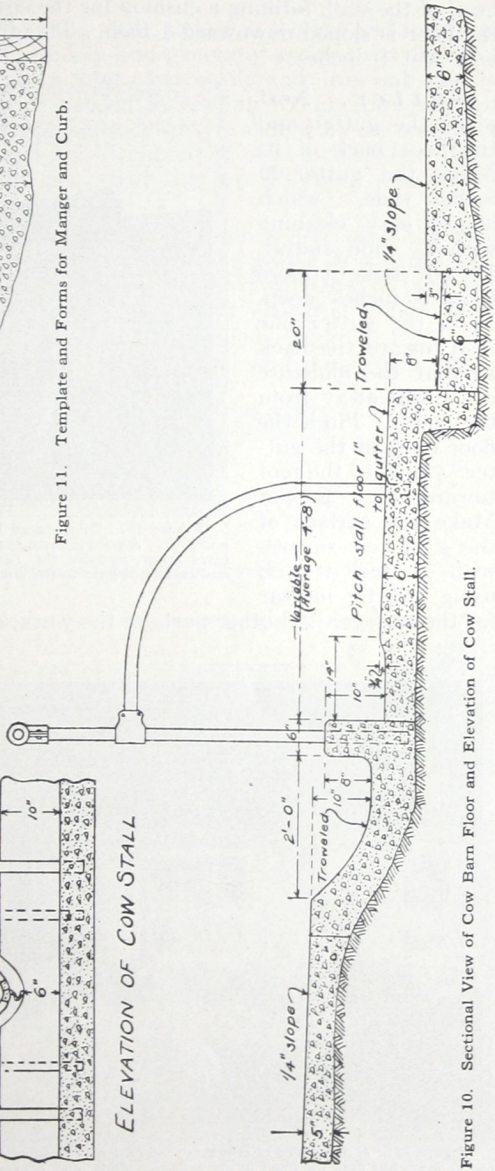


Figure 10. Sectional View of Cow Barn Floor and Elevation of Cow Stall.

Stall Floor. Lay the floor between the manger and the gutter next. It is a plain slab 6 inches thick with an apron 14 inches deep next the gutter. Figure 10 shows the first 14 inches of the stall floor (next the manger) to be ¾ inch lower than the rest. This keeps bedding at the head of the stall, forming a cushion for the cows' knees. Beyond this point the floor is sloped downward 1 inch. The distance from manger to curb is 4 feet 8 inches.

Gutter. Next place the gutter and the floor back of it. Make the gutter 20 inches wide, which allows easy cleaning with a wide shovel. Do not make it more than 3 inches deep. Pitch the gutter one inch toward the back so that the moisture can drain away from the cows. Pitch the floor back of the gutter ¼-inch to the foot toward the gutter. Make the surface of the gutter smooth with a steel trowel, using a little mortar for the surface. All other parts of the work, except the manger and curb,

Figure 12. Dilapidated barn surrounded by accumulated mud and filth. A poor investment because it wastes farmers' time, causes extra labor, impairs the health of live stock and farmer's family, and carries disease to the consumers of farm products.

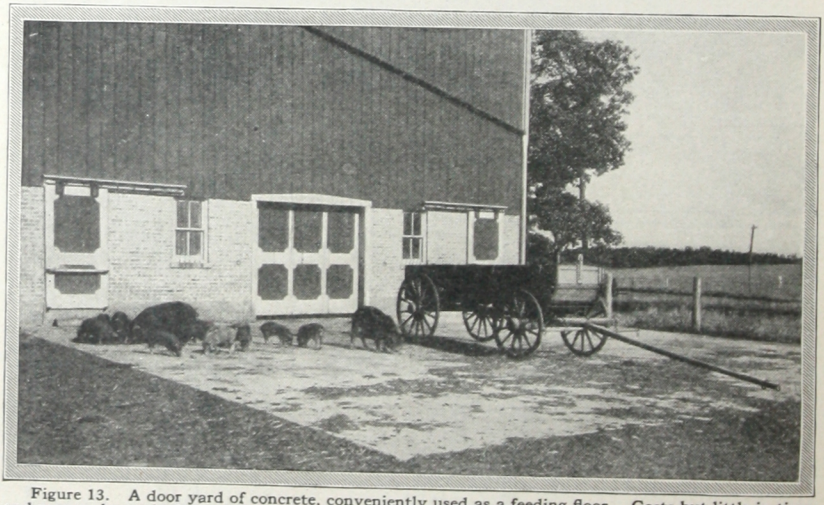


Figure 13. A door yard of concrete, conveniently used as a feeding floor. Costs but little in time and money, has paid for itself in convenience alone, and prevents waste of feed.

should be finished with a wooden float and brushed with a broom to make the surface rough.

Hog House Floors

A concrete slab rounded up to the walls, sloped to a drain and free from dips and hollows is the only sanitary and generally satisfactory floor for a hog house. Such a floor can be kept clean easily and dries out quickly after cleaning. No covering is needed in feeding rooms and pens not used for young pigs. Farrowing pens, however, should be covered with removable board mats, made of 2 x 4's spaced ⅜ of an inch apart. Build these only in the corner of the pen where the sow lies down and do not nail or fasten them.

Sanitation. Open gutters and frequent flushing will keep the floor sanitary. Figure 14 shows a good design for the gutter in a house with a center passageway and pens on both sides. A single row of pens will require only one gutter. Use a template such as shown in Figure 14.

Construction. Make hog house floors 6 inches thick, of 1:2:3 concrete. Finish off the surface with a wood float and roughen it with a broom.

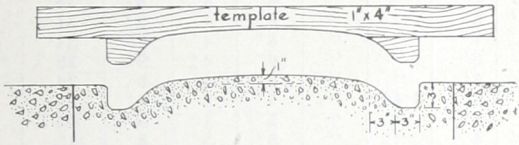


Figure 14. Type of Open Drain and Template for Forming the Gutter.

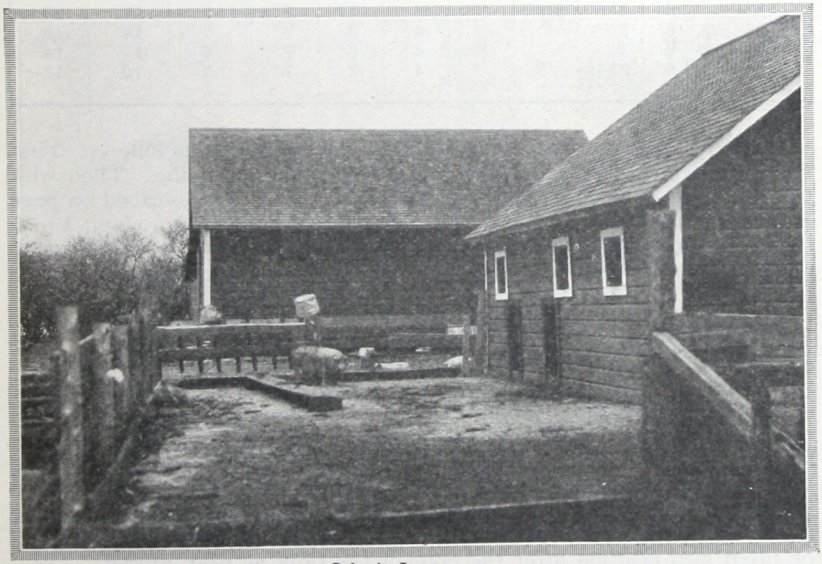


Figure 15. Hog Feeding Floor, near Oelwein, Iowa.

Stock Tanks (Rectangular)

A concrete floor around a watering tank makes it more accessible and sanitary. The tank should always be placed on or next the concrete floor. Stock tanks are generally made rectangular but sometimes circular. Forms for the rectangular shape are easier to make but contractors often build circular forms for repeated use.

Dimensions for Rectangular Tanks. The table below shows the proper dimensions for rectangular tanks, their capacity, and the quantities of materials required. Figure 16 shows a typical layout for a tank and floor.

Dimensions and Materials for Rectangular Tanks.

Capacity in Barrels	DIMENSIONS FOR FIGURE 16							MATERIALS		
	A	B	C	D	E	F	K	Sacks Cement	Cu. ft. Sand	Cu. ft. Gravel
56	16′	8′	2′11″	2′2″	6″	4″	9″	39	75	98
48	16′	7′	"	"	6″	4″	9″	35	68	89
40	16′	6′	"	"	6″	4″	9″	31	60	80
42	14′	7′	"	"	6″	4″	9″	31	60	80
34½	14′	6′	"	"	6″	4″	9″	28	54	71
28	14′	5′	"	"	6″	4″	9″	24	47	62
31	12′	6′	2′10″	"	5″	3″	8″	21	40	52
25	12′	5′	"	"	5″	3″	8″	18	35	46
19½	12′	4′	"	"	5″	3″	8″	15	30	39
21	10′	5′	"	"	5″	3″	8″	15	30	39
16	10′	4′	"	"	5″	3″	8″	13	26	33
11	10′	3′	"	"	5″	3″	8″	11	21	27
13½	8′	4′	2′9″	"	4″	2″	7″	9	17	22
9½	8′	3′	"	"	4″	2″	7″	7	14	18
7	6′	3′	"	"	4″	2″	7″	6	11	14
5½	6′	2½′	"	"	4″	2″	7″	5	10	12

Outside Floor. If the floor is not in place, proceed as follows: First lay the necessary pipes, setting them well below frost line. Then with the sub-base of the floor and tank prepared as already described on page 5, build the floor around the tank. Make the center opening about 1 inch larger all around than the tank itself. The floor should be sloped away from the tank and divided into sections not over 6 feet square, as shown in Figure 16.

Forms. The tank forms are simple in construction and can be built in convenient units while the floor is hardening. Figure 17 shows the forms constructed of 1-inch timber with 2 x 4-inch braces and stiffeners. The outer form is made the same height as the tank above the floor—this should not exceed 3 feet and 30 inches is preferable. It is built in four separate sections which can be nailed together at the corners when needed. The inner form is made equal in height to the depth of the tank and is set in an inclined position so as to give a batter on the inside of the tank wall. The inside form with braces should be nailed together complete so that it can be lifted into position after the floor of the tank as been placed.

Forms made of lumber not thoroughly dried keep their shape better than those of dry material. If well seasoned lumber is used, it would be better during dry weather to sprinkle the forms thoroughly before they are assembled. Wetting the surface against which the concrete is to be

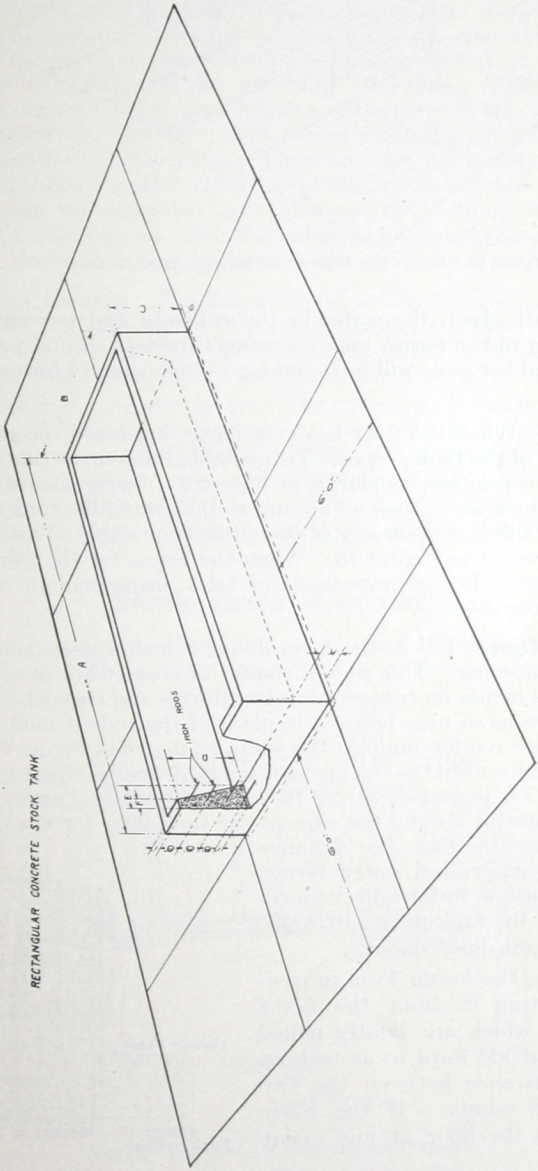


Figure 16. Layout for a Rectangular Stock Tank with surrounding floor.

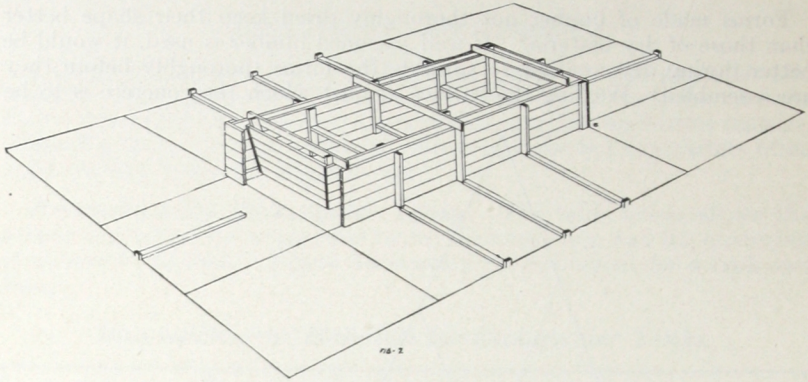


Figure 17. Forms and Bracing for rectangular stock tank.

placed helps to keep the water in the concrete and prevents the latter from sticking to the forms, making removal easier. Equal parts of boiled linseed oil and kerosene will be found a good dressing for forms and reduces warping.

Mixture. When the floor has sufficiently hardened, proceed with the construction of the tank proper. To assemble the four sections of the outer tank forms in position, as shown in Figure 17, forms should extend over the edge of the floor ½-inch all around so that when the tank is completed no part of it will rest upon any of the outer floor slabs. This will be made clear by reference to Figure 18. When the forms for the tank are ready, mix the concrete in the proportions of 1:2:3, using enough water to give a "quaky" consistency.

Construction. Fill in the form about 3 inches deep and then place the floor reinforcing. This should consist of a net-work of ¼-inch round rods placed 9 inches on centers both lengthwise and crosswise of the tank, or heavy wire mesh may be used in place of the rods if more convenient. Carry the floor reinforcing into the walls, as shown in Figure 18. Next fill in with concrete until the thickness of the tank floor is equal to K as given in the table on page 14. Strike the concrete off level and apply a little 1:2 cement mortar around the edge of the tank floor for a width of about two inches greater than the distance between the inner and outer forms. This will insure a watertight connection between the tank floor and walls. Trowel the tank floor smooth.

Then place the inside form in position, supporting it from the 2 x 4 cross braces which are lightly nailed across the outside form so as to keep a uniform distance between the two forms at all points. If the inner form touches the floor at any point

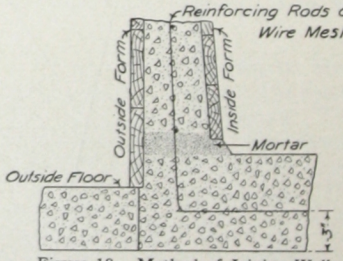


Figure 18. Method of Joining Walls of Tank to Floor.

remove the mortar top so as to give a clearance of about ¼-inch all around. A 1:2 cement mortar should then be placed between the forms and worked until it flushes through and is even with the inner face of the inside form. If this layer of mortar is at least 1 inch thick it will insure a watertight joint. If using rods as reinforcing, a ¼-inch round or square rod should now be embedded in the mortar, 2 inches from the outer form and running all the way around the tank. Lap the reinforcing, if more than one piece is necessary, for a distance equal to 64 times the diameter; for a ¼-inch rod this would be 16 inches. Make the lap on a side, not at a corner. Then place 8 inches of concrete in the form and place another rod as before. Another eight inches will bring the concrete within an inch of the top of the forms. Then another reinforcing rod and an inch layer of cement mortar spread over the top completes the tank. It is well to make the edges of the wall round by running an edger along the inner and outer forms after the concrete has partially hardened, requiring that the cross braces supporting the inside form be removed.

Removal of Forms. The forms should not be removed until the concrete has hardened sufficiently to prevent damage. Under favorable conditions the inner form of the tank may safely be removed in two or three days, but the outer form should remain on for a week.

In cool weather longer time must be given, as the concrete hardens more slowly. While hardening, the concrete should be protected from rapid drying in warm weather and freezing in cold weather, which would prevent its gaining proper strength. The work should be examined carefully, as too early removal of the forms results in broken edges and corners, if not in more serious defects which will detract much from the appearance of the tank.

Stock Tanks (Circular)

Because of its shape, a circular tank will resist freezing better than a rectangular tank. The circular form of tank gives a greater capacity for

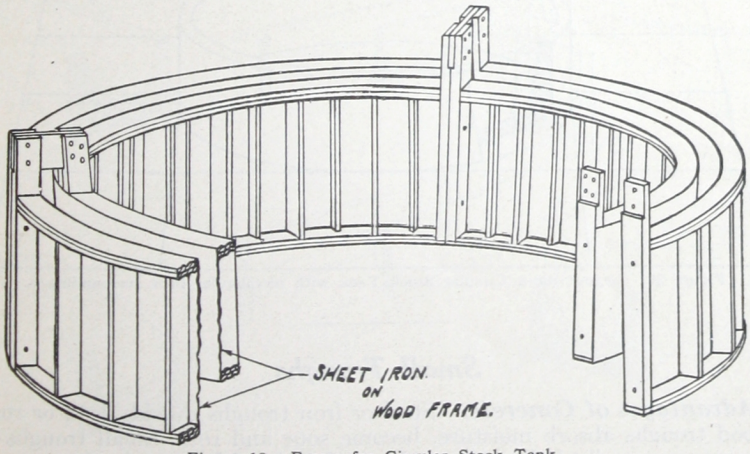


Figure 19. Forms for Circular Stock Tank.

the same amount of material, yet the forms are difficult to construct and, therefore, somewhat expensive. If several farmers will buy a form to use jointly in building several tanks it may be wise to use a circular form, but one farmer alone had best use the rectangular shape.

Tank Form. The form shown in Figure 19 was designed by Alfred Olson of Elkhorn, Wis., and has been successfully used for many years.

Construction. The construction of a round tank can be carried on as already described for rectangular tanks if the opening left in the center of the surrounding floor is made circular and 2 inches greater in diameter than that of the diameter of the proposed tank. If it is found more convenient to make the opening rectangular, however, then a foundation slab should be constructed, filling this area to the level of the surrounding floor. This slab should be reinforced with wire mesh.

Build the square foundation slab 2 inches greater in size than the proposed tank. Place 2 inches of concrete in the forms; place a layer of wire mesh over the whole surface and fill with concrete up to the proposed level of the surrounding floor. The concrete should be struck off and can be trowelled smooth on the corners which the tank will not cover. Next build an outside floor as already described. This may be round if the entire barnyard is not to be floored, but a rectangular floor is the simpler construction.

The form for the tank should then be placed after the floor has had sufficient time for hardening, and the succeeding steps are identical with those for a rectangular tank.

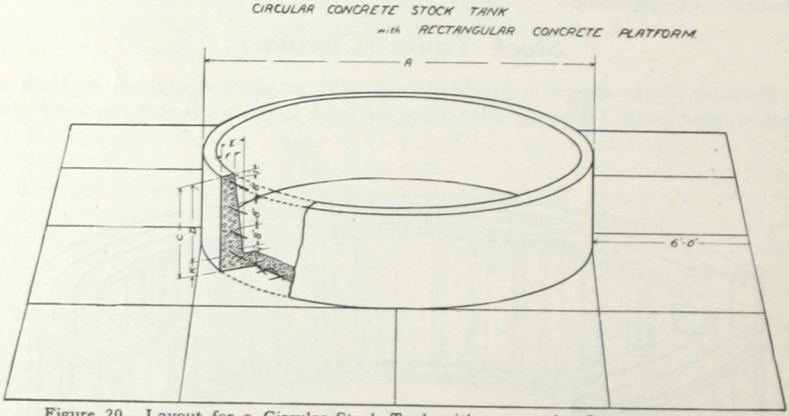


Figure 20. Layout for a Circular Stock Tank with rectangular floor surrounding it.

Small Troughs

Advantages of Concrete. Steel or iron troughs quickly leak or rust. Wood troughs absorb moisture, become sour and rot. Small troughs of concrete are easily built, using odds and ends of lumber for forms, and

are permanent and sanitary. The troughs shown in Figure 21 are good types for general use about the barnyard.

Casting Troughs Upside Down. Sketch "B" in Figure 21 shows a form for casting a trough upside down using an earth core. It is a good plan to work on a concrete floor or on a level plat of ground a little larger than the trough. Build up the core approximately of the shape wanted, using plastic earth or clay and shaping it with a template. Make the bottomless box for the outer form and hold it in place by stakes, if working directly on the ground, or if working on a concrete floor hold it in place with weights or braces.

Work the core up to the exact shape wanted so as to give a uniform thickness in the concrete walls. The height of the core will be equal to the depth of the trough. When pouring concrete into the mold use a shield so that the fresh concrete will not knock off pieces of the core, making the inner surface rough.

Sketch "D" shows a similar trough except that a wooden core had been used instead of earth and both inner and outer forms set on a wooden pallet instead of on the ground.

Template Method. The trough shown in Sketch "E" can be easily cast on a wooden pallet or in place on a slab foundation of a concrete floor.

Reinforcing. The reinforcing for troughs consists either of wire mesh, ¼-inch iron rods or both. If the tank is cast as in Sketch "E" and is not to be moved wire mesh is sufficient. But otherwise there should be three rods in the base, 1 inch from the surface.

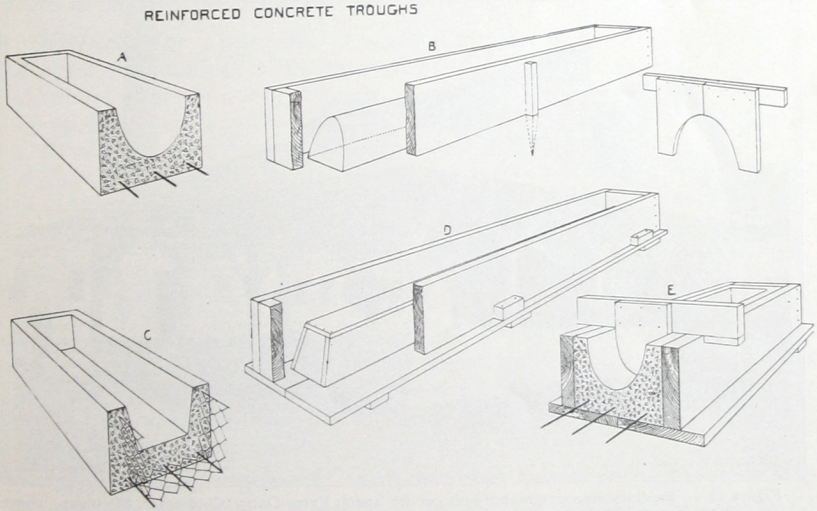


Figure 21. Concrete Troughs which are efficient, at the same time simple to construct.

Manure Pits

Bulletin No. 34 by the Missouri Agricultural Experiment Station discloses an amazing loss in manurial value due to the common practice of throwing manure out where the moisture will run off or be evaporated out by the sun. The Bulletin says in part: "The common method of storing manure usually results in a loss of one-third or more of its value by leaching. Moreover the materials thus leached out are the most soluble and therefore the most available portion of the manure. All three of the valuable elements, viz.: nitrogen, phosphoric acid and potash, are affected by this leaching process." The same Bulletin says: "It is believed that more than half the manure produced in Missouri is wasted," and places this waste at no less than $75,000,000 annually.

Value of Liquid Manure. Authorities have commonly estimated that one-half of the value of barnyard manure is found in the liquids. This being true, it becomes necessary at the outset to adopt some plan by which this may be saved. The concrete manure pit immediately suggests itself as the most convenient and economical scheme for the storage of manure.

Common Types of Pits. Two types of pits are in common use, the first consisting merely of a flat concrete floor surrounded by concrete walls and the second having sloping floors, draining into a sump or tank. The first type is the easier to construct, and if protected from the sun it preserves the liquids of the manure which would otherwise be lost by seepage, evaporation and firing. The second type possesses the advantage of

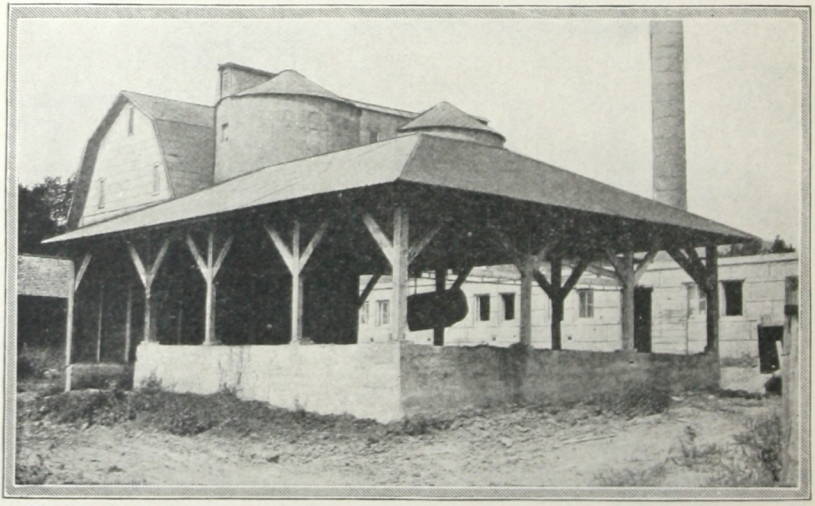


Figure 22. Sanitary concrete manure pit on the Beach Farm Dairy, Coldwater, Michigan, where all the manure is saved, including the liquid content. Saves labor in handling the manure, and odors and flies are kept away from the cow stable. R. C. Angevine, builder.

Figure 23. The fumes from this manure pile enter the dairy barn through the windows, contaminating the milk. One method of spreading contagious disease.

draining the valuable liquid off the manure, to be pumped out and sprinkled over the fields by means of a liquid manure spreader.

Either type of pit may be improved by completely screening in, excluding flies which would otherwise breed in the manure and carry contamination to milk and other food products.

General Notes on Manure Pit Construction

The height of the pit walls should not exceed 4 feet, giving a depth of about 3 feet inside the pit for manure. Shallower or deeper pits interfere with the bacterial action and are less efficient.

Allow 50 feet of manure pit surface for each full grown head of stock. Locate the pit near the cattle barn to shorten the haul of litter, but not within 100 feet of the milk or dairy house. Build up the walls thicker at the base than at the top with the outer surface perpendicular. This taper helps in packing the manure. Round out the corners.

Mixtures for Concrete. Concrete for the walls of pits should be of a 1:2½:4 mixture. One cubic yard will require 5½ sacks of cement, 14 cubic feet of sand, 22 cubic feet of screened gravel or stone. Concrete for all floors and for the roof and walls of manure pit cisterns should be made of a 1:2:3 mixture and 1 cubic yard will require 7 sacks of cement, 14 cubic feet of sand and 21 cubic feet of screened gravel or stone. For all of this work concrete should be mixed wet enough so that it will flatten out from its own weight when piled, but will not flow readily.

Pit without Liquid Manure Cistern

A simple manure pit without sump or cistern is practically a small section of common barnyard floor surrounded by four concrete walls 4 feet high and having a slight taper outward. Locate such a pit in the shade of the barn or else build a roof over it. Make an opening in the walls so that a wagon or spreader can be driven into the pit.

Construction. Make the walls 10 to 12 inches in thickness without reinforcing. Build them down below frost line and 3 to 4 feet above the

ground level. Figure 24 shows a convenient form. If the sides are longer than 50 feet place a vertical joint in the wall to provide for expansion and contraction with weather changes. This may be done by setting a board vertically in the form with a small tapered strip nailed to the center, as shown in Figure 25. The board is removed when the concrete has set and the next section cast directly against the first.

Forms. If there is plenty of old lumber available build a complete form so that concrete may be cast continuously. It will be more economical, however, to build sectional forms casting each side separately. One-inch boards, dressed on one side, lightly nailed to 2 x 4's 16 inches apart, make a satisfactory form and if the faces are brushed with crude oil or whitewashed they are easily removed. If a roof is to be built make provision for anchoring supports into the walls before the concrete is placed.

The concrete surfaces will be improved by spading the mixture back from the forms by means of a sharpened 2 x 4 or a spade. This brings the finer materials to the face of the form and makes a smoother surface.

After the walls are sufficiently hardened a single course floor should be laid following the methods given on page 5.

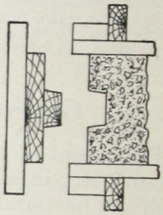


Figure 25. Method of joining foundation walls where it is necessary to leave an expansion joint, or where concreting has been discontinued for any reason.

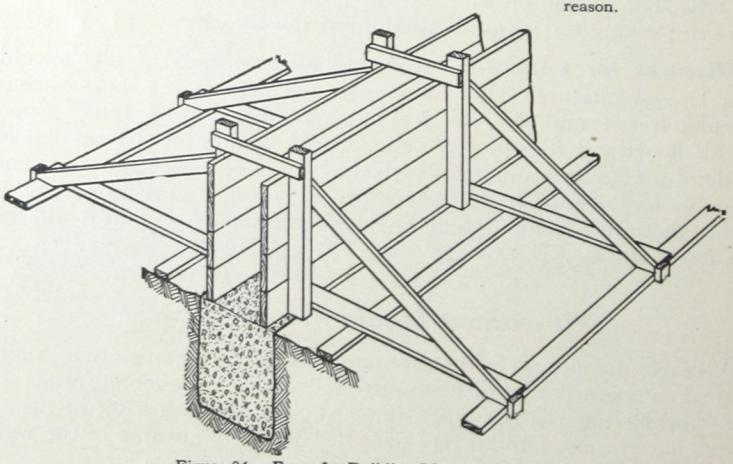


Figure 24. Form for Building Manure Pit Walls.

Manure Pit with Cistern

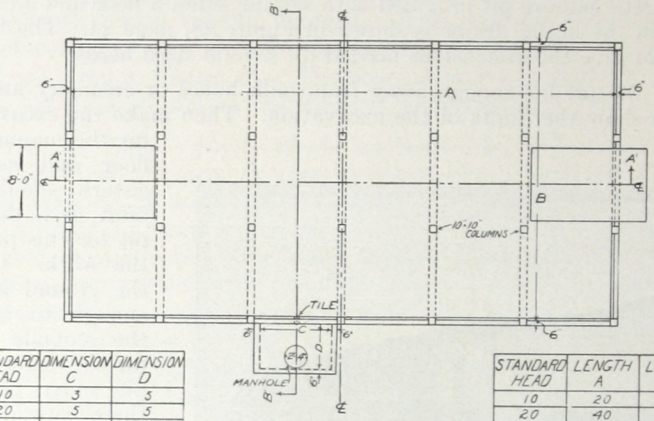
A concrete manure pit provided with sloping sides, a floor and a cistern into which the liquid drains is shown in Figure 28, page 24. The tables on page 24 give the dimensions needed for several sized herds.

Locate the pit far enough away from milk house or creamery and set stakes to show the limits of the excavation. Then make the excavation for the manure pit floor and, as the cistern should be built first, dig the pit for this part of the work. Unless the ground is stiff enough to act as the outside form for the cistern, the pit must be dug three feet wider and longer than the outer dimensions of the cistern when completed, to give room for building the forms. The depth should be 8 feet below the top of the completed

Figure 26. Type of cheap makeshift dairy barn and exposed manure pile. An inefficient and unsatisfactory plant for the owner and a menace to the public health.

Figure 27. Concrete manure pit at the Burn-Brae Hospital, Primos, Pa. An efficient structure of reinforced concrete.

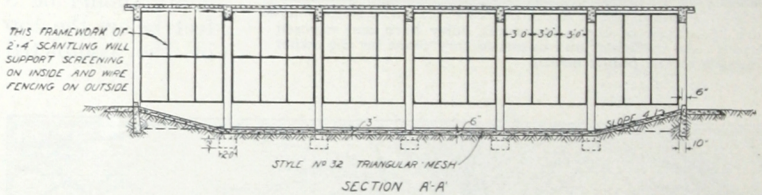
REINFORCED CONCRETE MANURE PIT
WITH SCREENS AND CONCRETE ROOF



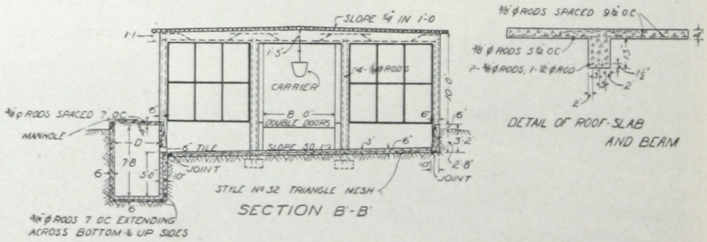
STANDARD HEAD	DIMENSION C	DIMENSION D
10	3	5
20	5	5
30	8	5
40	9	6
50	10	7

STANDARD HEAD	LENGTH A	LENGTH B
10	20	30
20	40	30
30	60	30
40	80	30
50	100	30

Plan of Manure Pit with Cistern for liquid manure.



Sectional View A-A of Manure Pit with Cistern.



Sectional View B-B of Manure Pit with Cistern.

Figure 28. Reinforced concrete manure pit with screens and concrete roof.

cistern. Lay the cistern floor 6 inches thick, as shown in the lower sectional drawing. This floor is reinforced with ⅜-inch round rods spaced 7 inches apart and run in both directions. This reinforcing should be laid down and wired at all intersections and the ends should be bent up on all sides so that they will extend up into the walls not less than 30 inches. The rods should be made ready on the ground outside, 3 inches of concrete placed for the floor, the rods then set in place and the remaining 3 inches of concrete placed immediately. Trowel the surface smooth except a narrow strip along the edge, on which the walls will rest, which should be left quite rough.

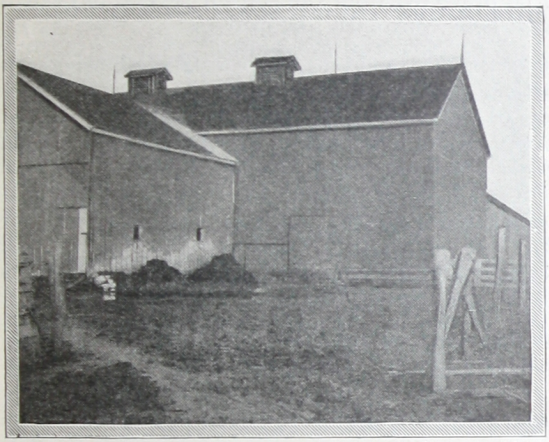


Figure 29. An old style barn with a filthy yard. In dry weather the yard is dusty and the wind carries into the milk an enormous amount of repulsive dirt. In wet weather the yard is a mass of filth. Filthy barnyards cause filthy disease-infected stock.

Place the inner wall forms as soon as the floor has hardened sufficiently to support the weight of a person and before it has dried out. The inner forms should be placed in position first, taking great care to brace them securely, especially at the bottom. Stand on a wide board while working on the floor.

Reinforcing rods should then be put in, first wiring the vertical rods to those extending up from the floor, then wiring the horizontal rods to the verticals. Three-eighths-inch rods spaced 7 inches apart both vertically and horizontally will be used for the walls the same as for the floor.

After the reinforcing rods are placed, the outer forms should be put up and securely braced against the surrounding earth. The cistern wall on the side next to the pit will be carried up to form a part of the pit wall itself at that point and all forms except the outer form on the side next to the pit should be carried perpendicular to the cistern roof. The outer form should be carried up perpendicular to a point on a level with the bottom of the pit floor, and then tapered toward the top of the wall, since this section is a part of the sloping wall of the pit. Place a 6-inch tile or pipe as shown in the lower sectional drawing to conduct the liquid manure from the pit to the cistern.

The form for the cistern roof should also be put in place (supported on the top of the inner forms for the cistern walls), a frame being provided for a manhole opening 2 feet 4 inches in both dimensions, made circular or square as preferred. After the forms have been carefully inspected

to make sure that the bracing is ample and all the joints tight, place the concrete (of a "quaky" consistency), taking care to carefully spade the larger particles back from the surface of the forms by the use of a narrow chisel-edged board, spade or a steel tool especially designed for the purpose. The vertical reinforcing rods in the walls should be bent over into the roof and spliced to the roof reinforcing which also consists of $\frac{3}{8}$-inch rods, 7 inches apart, the same as for the floor and walls. Concrete of the same mixture used in the walls should be placed on the roof, taking care to lodge the reinforcement not more than $1\frac{1}{2}$ inches from the lower surface. The upper surface should be given a slope of one inch (away from the pit) and should be troweled smooth to carry off the water. If in an exposed position the roof should be protected from the sun for several days by a covering of straw or earth kept constantly damp.

Pit Walls. The walls of the pit should next be constructed, using concrete of the same proportions used in other parts of the work. No reinforcement is necessary for the wall itself. The footings for the walls should go down below frost line, a depth of 3 feet below the surface usually being sufficient. The pit walls should extend at least 6 inches above the ground line to prevent surface water from entering.

The necessary filling and grading should then be done for the pit floor and the ground in all fills well compacted. It is advisable to cover all ground which has been disturbed with four or six inches of gravel or cinders to protect the floor against possible settling.

Floor. The floor slab may next be laid in one course six inches thick, using the proportions specified above. Three inches of concrete should

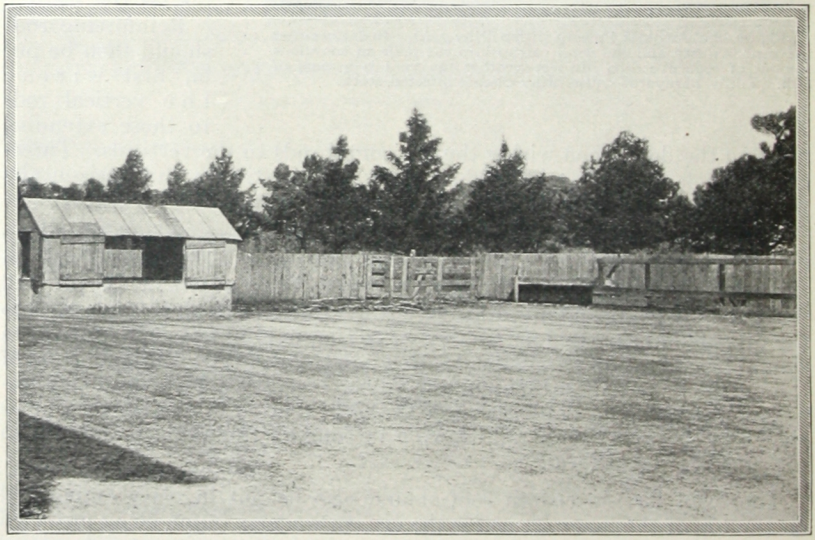


Figure 30. Concrete barnyard pavement and stock tank on the Ed. Harvey farm, La Fox, Illinois. A permanent improvement which will yield big returns in saving of feed and labor, not to mention the sanitary advantages.

first be laid down over the entire surface of the floor. Cover this with style No. 32 triangle mesh reinforcement and immediately add the balance of the concrete. The floor surface should be protected against sun in the same manner as described for the cistern roof.

A narrow floor or apron is often constructed around the outside of the pit for the purpose of making it more accessible for animals which are driven into the pit to tramp down the manure and also to prevent the admission of ground water. Such aprons may be made, in single course work, 30 inches wide and 6 inches in thickness and may be given a drop of 1 inch in 4 away from the pit walls. These aprons should be constructed in the same manner as the pit floor except that they will require no reinforcing, and they must be divided into slabs.

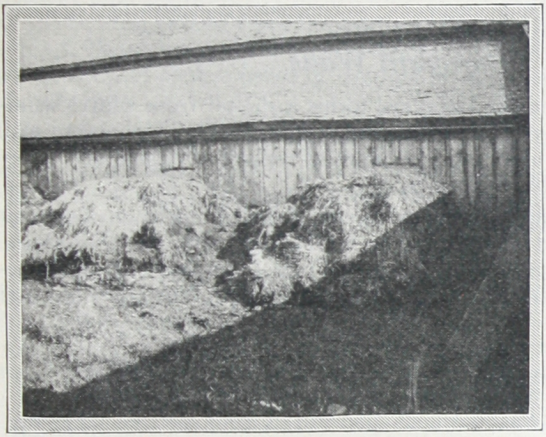


Figure 31. Manure pits where flies breed and disease germs multiply—75 per cent of the fertilizer value lost by leaching and firing. Owner prohibited from supplying milk to the City of Chicago.

Columns and Roof. A reinforced concrete roof and screened-in sides are very desirable although not entirely necessary adjuncts to the manure pit. The roof slab may be supported by concrete beams 13 inches deep by 10 inches wide, resting on a system of 10x10-inch columns. The column foundations will have to be laid and the columns themselves built before constructing either the pit walls or the floor. These foundations should be on firm ground, their tops at least 12 inches below the proposed floor level, and they should be 2 feet square by 12 inches deep. Since the pit walls will be constructed as panels between the columns, recesses into which the walls will be keyed should be left in the columns. These can be made as shown in Figure 35, but should only extend from the bottom to the top of the pit wall itself.

The columns, beams and roof slabs are all reinforced, the columns with four $\frac{5}{8}$-inch rods placed one near each corner and the beams with two $\frac{5}{8}$-inch round rods and one $\frac{1}{2}$-inch round rod placed between them, one inch above the bottom as shown in the small sectional view at the lower right hand corner of Figure 24.

The center rod in each beam will be bent up as shown in the lower sectional view. Each slab is 9 feet 10 inches by 8 feet 10 inches between centers of supports, and is 4 inches thick. The reinforcing consists of $\frac{3}{8}$-inch

round rods spaced 5½ inches center to center perpendicular to the beams and placed 1½ inches from the bottom of the slab. On top of these are similar rods spaced 9½ inches center to center parallel to the beams. Further directions for the construction of reinforced concrete columns, beams and roof slabs will be found in "Small Farm Buildings of Concrete," a copy of which will be sent you free of charge upon application to any office of this company.

Barnyard Walls

A concrete wall around the barnyard forms a shelter from winter winds and considerably improves the appearance of the yard. A concrete wall is inexpensive, easy to build, will never need repairs, will support heavy gates and is far preferable to a fence.

The barnyard wall may be of columns and slabs, of blocks or of cement plaster construction and should be 5 to 6 feet high with a coping at the top for appearance. Figure 32 shows a wall of column and slab construction. The columns are 8 inches square, reinforced with four ½-inch round

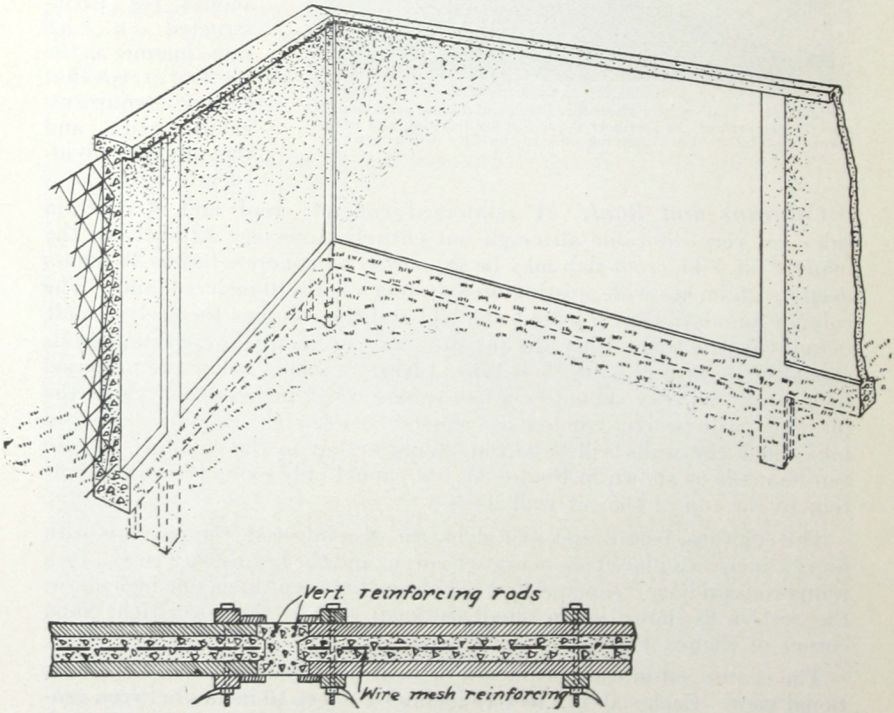


Figure 32. Barnyard Wall of Concrete, with horizontal section showing forms.

rods and are spaced 12 to 14 feet apart. The slabs are 4 inches thick, reinforced with triangle mesh reinforcement, Style No. 42, or heavy fencing, and are made to fit into vertical recesses in the columns. They are supported on a light concrete curbing.

Column and Slab Wall. Cast the columns first, in place or on the ground, in a mold like that shown in Figure 35. The columns should be 3 feet longer than the height of the wall above the ground and vertical recesses 2 inches deep, 2¾ inches wide at the surface and 2½ inches wide at the bottom extend from the bottom of the columns to the inside of the coping, 2½ inches from the top. Similar recesses should be placed on opposite sides of each column of the line posts and on adjacent sides of the corner posts.

Construction. Take care to have the columns perfectly level and in true alignment. Build a curb 8 inches wide and 12 inches deep between the columns and extending 4 inches above the ground. This will act as a foundation for the slab. No form is necessary for this other than light boards held in place by stakes.

The slab forms are shown in Figure 33. Build these of 2-inch lumber, the face boards being planed on the side next the concrete. Make the length of the slab forms equal to the clear distance between columns. Three vertical braces fastened to the face boards with heavy wood screws should make the sections rigid. Hold the two forms in place by means of six ½-inch bolts, 15 inches long. Nail vertical strips on the ends of the face boards to hold the form in position, securing them rigidly to the columns.

Slab Reinforcing. When the forms are in position place triangle mesh reinforcement between the forms so that it will be in the center of

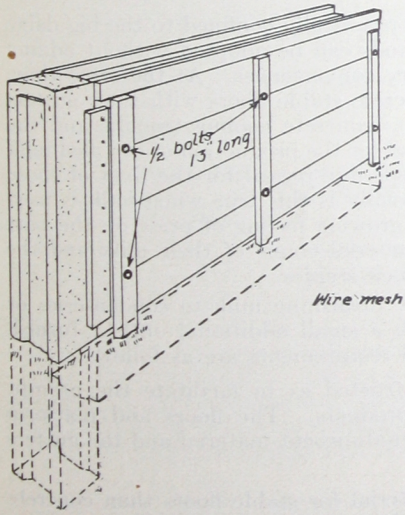


Figure 33. Forms for Barnyard Wall of concrete.

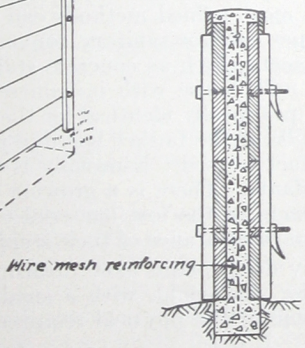


Figure 34. Section Thru Wall showing Forms in place.

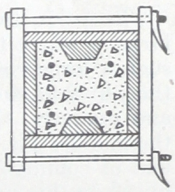


Figure 35. Section of Post cast in place showing Forms and Clamps.

the completed slab. Cut off the reinforcement into lengths equal to the length of the slabs and roll it backwards so that it will be straight when placed between the forms. Hold it near the center by means of spacers of light boards which can be drawn out as the concrete is placed.

Form the coping by nailing two strips along the upper edge of the forms as shown in Figure 34. This will make a coping extending 2 inches beyond the surface of the wall and as wide as the column. The coping will have a height of 2 inches at the sides and for drainage should be troweled off so as to make it somewhat higher in the center.

Mixtures and Consistency. Mix the concrete in the proportion of 1:2½:4. Use stone ranging from ¼ inch to 1 inch. The concrete should be wet enough to flatten out under its own weight. A chisel-shaped 2 x 4 or a spade worked vertically along the surface of the form as the concrete is placed will bring the finer particles to the surface, leaving it smooth and without air pockets or holes. Protect the wall from sunshine and keep it damp for several days after completion.

Concrete and the Requirements for Certified Milk Production

Safeguarding the food supply in large cities is becoming an increasingly difficult problem, but the results obtained are worth the effort. It may seem that the farmer producers have to stand more than their rightful share of the additional cost of producing clean milk and yet this is hardly true. Clean milk should and eventually will bring more money than that produced under unwholesome conditions and if this is not now universal the tendency is in that direction.

The production of certified milk is practically confined to the big dairy farmers where the most refined methods can be adopted without adding such a large cost per cow for sanitary conveniences. At the same time, the physical equipment, such as concrete stable floors with their gutters and mangers, the milk house with its concrete cooling troughs and the the manure pit, is practically identical for the production of certified milk and of common milk, if the farmer has due regard for the lives of those by whom his product is used. Especially is this true when milk is used by invalids and infants. There is a growing feeling of pride on the part of progressive farmers in the low bacterial count of their milk and the clean and wholesome appearance of their stables.

There are many dairy plants now furnishing milk to condenseries or to city distributors, who could, with a small additional outlay, furnish certified milk. Some of the physical requirements are as follows:

1—"The stable shall be so constructed as to facilitate the prompt and easy removal of waste products. The floors and platform shall be of cement or other non-absorbent material and the gutters of cement only."

There is no more economical material for stable floors than concrete and it is sufficiently good for the highest grade of product.

2—"The inside surface of the walls and all interior construction shall be smooth with tight joints and shall be capable of shedding water."

In other words, concrete floors, walls and ceilings are good and sufficient.

3—"The cow stable shall be provided with adequate ventilation .....each cow to be provided with a minimum of 600 cubic feet of air space."

4—"A sufficient number of windows shall be installed and distributed so as to provide satisfactory light and a maximum of sunshine; two feet square of window area to each 600 cubic feet of air space representing the minimum."

5—"All necessary measures should be taken to prevent the entrance of flies and other insects, and rats and other vermin into the building."

In other words, the floors must be of concrete to prevent the harboring of rodents.

6—"Soiled bedding and manure shall be removed at least twice daily and the floors shall be swept and kept free from refuse."

It is impossible to keep a wood floor swept clean. Concrete is easily swept, is easily flushed and makes the best looking floor that can be built at reasonable cost.

7—"Manure, when removed, shall be drawn to the field, or temporarily stored in containers so screened as to exclude flies."

While this section does not demand a concrete manure pit to store the surplus, yet there is only one material to use, in the opinion of those who have studied the problem. Concrete makes a water-tight wall and floor which retains 100% of the fertilizer value and the cost of concrete is not heavy.

8—"The dairy building shall be kept clean..... .....and the floors shall be graded and water-tight."

This would permit the use of expensive marble for floors but concrete is the only practicable material. While plastic, it can be graded to drains and it is water-tight.

These are some of the clauses of the contract made by the Chicago Medical Society Milk Commission with each dairy whose product receives its certification, but they may profitably be put into use by every dairy farmer. These are not expensive improvements and considering that they mean so much in the quality of milk, and that the time is shortly coming when milk will be sold on a quality basis, it behooves the farmer to make his new construction conform to the highest present standards. This will not cut heavily into his profits but should, in a short time, mean greater profits by increasing both the quantity and quality of the product.

UNIVERSAL

PORTLAND CEMENT

It isn't enough to say just "Cement"

—

Ask for "UNIVERSAL"

The best building supply dealers, thousands of them, handle UNIVERSAL